

# THE RELATIONSHIP AND OSTEOLOGY OF THE CAPROID FISHES OR ANTIGONIIDÆ.

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## INTRODUCTION.

The osteological characters of the family Antigoniidæ (Caproidæ) as exhibited by the Japanese species *Antigonia rubescens* (Schlegel) point to an affinity with the Chaetodonts. The following characters seem to indicate a rather close relationship:

1. *The striking similarity in appearance and construction of the cranium to that of the genus Chaetodon.*

2. *The continuity of the supraoccipital crest with the pterotic crest.*

In both *Antigonia* and *Chaetodon* the supraoccipital crest is high and declivitous; its anterior edge is thickened to a ridge on each side, which descends in a curve, and is continuous backward with the pterotic crest.

3. *The simple unforked posttemporal.*

In *Chaetodon* the posttemporal is a simple, straight bone, with a slight tubercle developed at its lower end (in place of the usual lower fork) for attachment to the opisthotic. The posttemporal in *Antigonia* shows even a greater degree of modification, the tubercle being entirely absent.

4. *The imperforate prefrontals.*

In the bony fishes the olfactory foramen is typically through the center of the prefrontal. In *Antigonia* it is between the prefrontal and the ethmoid. *Chaetodon* and *Holocanthus* approach the latter condition in having the foramen barely contained by the prefrontal. Only a slight lamina of bone saves it from being between the prefrontal and the ethmoid.

5. *The meeting of the alisphenoids and consequent division of the anterior opening to the brain case.*

A character shared by *Antigonia*, *Chaetodon*, and *Holocanthus*.

6. *The enlarged first interhæmal.*

The first interhæmal in the Chaetodonts and in *Antigonia* is very

stout and long, running up to the vertebral column at the posterior part of the abdominal cavity. It is firmly held against the first hæmal spine. In *Chatodon* and *Antigonia* it is composed of the first three interhæmals coössified. In *Holocentrus* it is composed of the first two.

With the family Zeidæ (which, though perhaps related to the Chatodonts, seems to have no close affinities with any known family) *Antigonia* has the following characters in common:

Posttemporals unforked; prefrontals not perforated by the olfactory nerve; first interhæmal much enlarged, bordering the posterior part of abdominal cavity and reaching up to first abdominal vertebra.

#### DESCRIPTION OF OSTEOLOGY.

##### CRANIUM.

The occipital crest is high and declivitous; its anterior edge is thickened to a ridge on each side, which descends in a curve and is continuous with the pterotic ridge.

The anterior edge of the supraoccipital and the surface of the frontals bear sharply denticulated ridges, and all of the bones which are in contact with the skin are covered with small sharp spines.

The auditory organ forms a protruding capsule of thin, polished bone on each side.

The supraoccipital extends forward to above the middle of the eyes and widely separates the posterior ends of the frontals.

At the sides the frontals spread out fan-shaped, and rise steeply to the supraoccipital. They nearly reach to the pterotic supraoccipital crest posteriorly. Anteriorly they are deeply excavated for the reception of the backward-extending process from the premaxillaries. From above the orbital space a channel runs anteriorly from each frontal, and is continued on nasals to their anterior end.

The ethmoid is very small and is in a depression in the upper surface of the vomer. It bears a sharp keel above, which is on a level with the floor of the anterior frontal excavation.

The prefrontal is not pierced by the olfactory nerve; the olfactory foramen is between it and the ethmoid.

The nasal is large and curves downward at its end to the palatine, to which it is securely attached.

The vomer sends lateral wings upward from its sides, which are articulated to the prefrontal.

The parasphenoid expands laterally at the front of the prootic, and bounds the lower part of the myodome. From its lower surface a thin keel is developed. It extends, splint-like, over the basioccipital, reaching nearly to the posterior end of that bone.

The exoccipitals meet above and below the foramen magnum. From their posterior surface wings are developed for the reception of the end of the large second interneural.

The prootic forms the greater part of the myodome and auditory capsule.

A small basisphenoid bridges the lower part of the anterior opening to the brain case between the prootics. It has a small tubercle developed on its anterior edge, but it has no descending process.

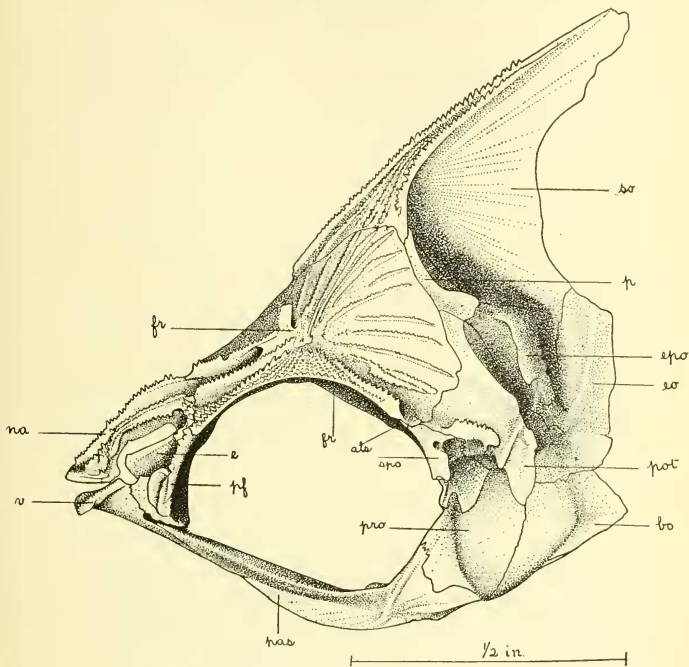


FIG. 1.—LATERAL VIEW OF CRANIUM OF ANTIGONJA RUBESCENS.

als alisphenoid.  
bo basioccipital.  
e ethmoid.  
eo exoccipital.  
epo epiotic.  
fr frontal.  
na nasal.  
p parietal.

pas parasphenoid.  
pf prefrontal.  
pot pterotic.  
pro prootic.  
so supraoccipital.  
spo sphenotic.  
v vomer.

The alisphenoids are united with each other and widely separate the upper and lower parts of the anterior opening to the brain case.

The pterotic sends a thin wing of bone downward and the opisthotic is developed over the posterior edge of its base. The posttemporal is securely attached at its lower end to the opisthotic.

The epiotic process is developed laterally and receives on its posterior surface the upper end of the posttemporal.

The parietals are largely covered by the frontals and show little except their posterior face behind the pterotic occipital crest.

The myodome is very large at its mouth, and tapers quickly to an extremely small pore opening to the exterior posteriorly.

LATERAL BONES OF HEAD.

The opercle is rather elongate and bears the subopercle on its lower posterior margin.

The interopercle occupies a peculiar position. It extends behind the large preopercle straight between the angular and the subopercle,

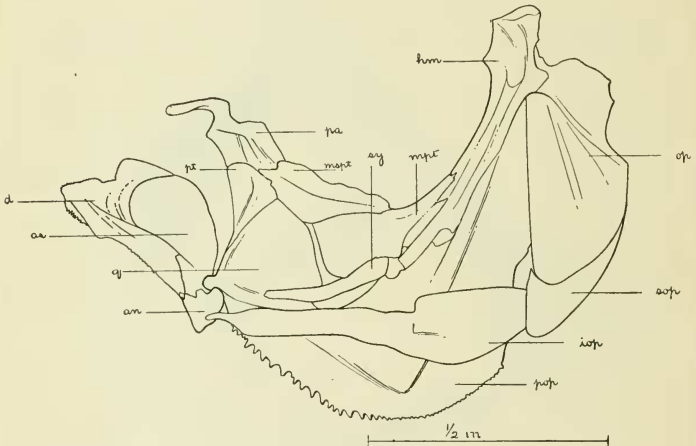


FIG. 2.—INNER SIDE OF "FACE BONES" OF *ANTIGONJA RUBESCENS*.

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|----------------------------|------------------------|
| <i>an</i> angular.         | <i>op</i> opercle.     |
| <i>ar</i> articular.       | <i>pa</i> palatine.    |
| <i>d</i> dentary.          | <i>pop</i> preopercle. |
| <i>hm</i> hyomandibular.   | <i>pt</i> pterygoid.   |
| <i>io</i> interopercle.    | <i>q</i> quadrate.     |
| <i>mpt</i> metapterygoid.  | <i>sop</i> subopercle. |
| <i>mspt</i> mesopterygoid. | <i>sy</i> symplectic.  |

and is almost entirely concealed from the outside by the large preopercle. At its middle is a small articular facet to which the end of the epihyal is attached.

The preopercle is very large. A ridge runs straight from its upper to near its lower margin, turns sharply at an angle, which is slightly more acute than a right angle, and runs straight to near the condyle of the lower jaw.

The head of the hyomandibular is undivided where it articulates

with the cranium. The process which it sends down to the symplectic is rather long and slender. To its anterior edge the metapterygoid sends a process which is connected to it suturally.

The palatine is short and broad, and is supported equally by the mesopterygoid and the pterygoid.

The pterygoid is triangular in shape, and occupies a position against the upper two-thirds of the quadrate.

The symplectic runs along the inner face of the quadrate to about the middle of that bone.

The mandible is very broad. There is no open space between the articular and the dentary. The edge of the dentary is raised abruptly above the level of the teeth at its posterior upper edge. Below it runs back to the angular.

The angular is well developed, and is connected to the anterior end of the interopercle by a ligament.

The preorbital and suborbitals are covered with small sharp points, and have the usual canal following their course. There is no suborbital shelf.

The maxillary and premaxillary resemble those of *Zeus*, though very small in comparison.

The backward extending process from the premaxillary runs obliquely upward, and is much longer than the lateral portion which forms the edge of the mouth.

The maxillaries curve forward below over the ends of the premaxillaries.

#### HYOID AND BRANCHIAL ARCHES.

The hypohyals are large and flat, the lower one the larger.

The ceratohyal is pierced by a large hole at its upper edge.

The epihyal is much deeper than long and bears a stout interhyal. Four of the six branchiostegals are attached to it; two to the ceratohyal.

The urohyal is very large; it reaches past the posterior end of the epihyal, and is nearly as deep as it is long.

The branchial bones are all present except the hypobranchial, as is usual. The inferior pharyngeals are rather long and are well separated. The toothed superior pharyngeals are three in number, one to each of the three posterior arches. They decrease in size backward, and each bears a single row of sharp curved teeth.

#### SHOULDER GIRDLE.

The posttemporal is not forked, and no tubercle is developed at its lower end for connection to the cranium. It is much widened at its lower end.

The supraclavicle is rather elongate and does not depart from its usual condition.

The lower elements of the shoulder girdle form a wide plate. The lower part of the clavicle is widened and the hypocoracoid is separated from it for most of its length by a large space, which is inclosed below by two small slender spurs, one reaching backward from the clavicle and another reaching forward from the hypocoracoid. The upper

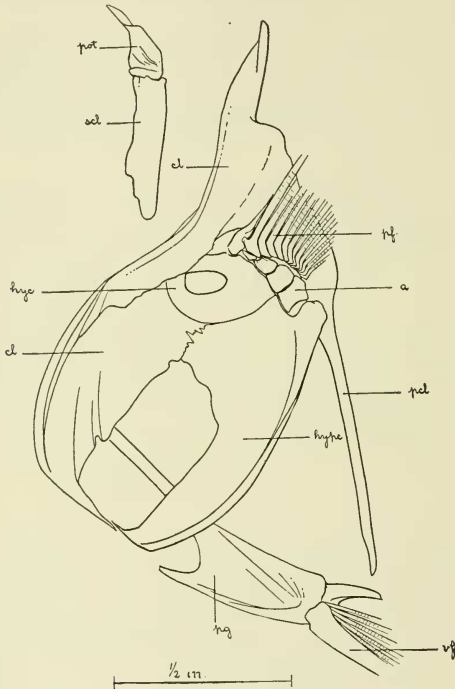


FIG. 3.—SHOULDER GIRDLE OF *ANTIGONJA RUBESCENS*.

*a* actinosts.  
*cl* clavicle.  
*hyc* hypercoracoid.  
*hyc* hypocoracoid.  
*pel* postclavicle.

*pf* pectoral fin.  
*pq* pelvic girdle.  
*pot* posttemporal.  
*sel* supraclavicle.  
*vf* ventral fin.

part of the hypocoracoid is connected to the clavicle by a rather short dentate suture. A thin crest springs from the posterior edge of the hypocoracoid and curving backward forms a small channel behind it.

About half of the hypercoracoid is above the hypocoracoid and half above the lower lamina of the clavicle. The opening through its center is large.

There are four short actinosts, the upper one the shortest. They are but slightly constricted at their middles. Three are borne by the hypercoracoid; one by the hypocoracoid.

The first upper short spine or simple ray of the pectoral works directly upon a condyle on the hypercoracoid.

The postclavicle is a single long spine curving downward toward the ventrals. Its upper end has a thin bony lamina developed above and below. It is firmly attached to the clavicle above.

#### PELVIC GIRDLE.

The opposite sides of the pelvic bones are suturally attached to each other. They send a long slender spine forward between the hypocoracoids and the clavicles. The spine fails to reach the anterior edge of the clavicles by some distance. A shorter, thicker spine runs forward below and at a slight angle with the upper one nearly to the lower end of the hypocoracoid. A thin lamina of bone bridges the space between the spines forming a chamber which is wide open in front and opens behind at each side of a short, vertical, intersecting partition on the lower surface of the girdle just in front of the ventral fins. A short process springs from the upper posterior end, just above the condyle for the ventral fins, and projects a short distance over the fins.

#### VERTEBRAL COLUMN AND APPENDAGES.

There are 9 abdominal vertebrae and 11 caudal, which, with the hypural, make 21.

The atlas is larger than the other vertebrae and is obliquely truncated on its lower anterior edge as in *Chaetodon*.

The zygapophyses are very small and are only developed anteriorly.

The parapophyses are not developed on the first four vertebrae. They grow progressively longer posteriorly.

Anteriorly the ribs are borne in pits on the centra of the vertebrae. As usual the first two vertebrae bear only epipleurals. Epipleurals are present on all ribs and are continued some distance behind the abdominal cavity.

The first tiny dorsal spine is attached to a small interneural which is coössified with the second interneural by a thin lamina of bone. The interneural reaches down nearly to the tip of the supraoccipital crest and helps to form the anterior outline of the body.

The second small dorsal spine is borne by an immense interneural which reaches to the base of the cranium and is clasped by two wings from the exoccipitals. A lamina of bone is developed on its posterior edge.

The third dorsal spine, though many times larger than the second is carried by a smaller interneural. The succeeding interneurals grow progressively smaller.

The interneurals from the dorsal spines lead each to a neural spine. Those from the dorsal rays are about three to each neural spine.

The three anal spines are attached to a single large interhamal, doubtless composed of the first three interhamals coössified. It reaches upward to the under surface of the first caudal vertebra.

The interhamals of the anal rays exceed the hamal spines in number in the same proportion as the interneurals of the dorsal rays exceed neural spines.